

III. CIRCULATION ELEMENT OF THE GENERAL PLAN

[Hercules]

CIRCULATION ELEMENT OF THE GENERAL PLAN

Government's role in the circulation element of the general plan is to provide a framework for the future development of the community.

A circulation element of the general plan is a statement of the community's goals and objectives for the future, and a framework for the future development of the community.

RELATIONSHIP TO THE GENERAL PLAN

1. Introduction

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- a. Transportation
- b. Mass transit
- c. Public works
- d. Communication systems
- e. Traffic safety
- f. Traffic engineering



III. THE CIRCULATION/SCENIC HIGHWAY ELEMENT

A. AUTHORITY

1. Circulation

Government Code Section 65302 (b) requires a Circulation Element in all City and County General Plans, as follows:

"A circulation element consisting of the general location and extent of existing and proposed major thoroughfares, transportation routes, terminals, and other local public utilities and facilities, all correlated with the Land Use Element of the Plan."

B. RESEARCH AND ANALYSIS

1. Introduction

The Circulation and Scenic Highway Element is concerned with: 1) the movement of people and commodities (including energy) through the City; and, 2) local planning for scenic highways in the City.

The Land Use Element and the Circulation Element of the General Plan must work together so that the land use impacts and needs and the circulations/transportation system capability are coordinated. Projections of the traffic which will be generated by future development are the basis for the planned circulation system improvements in the Circulation Element.

This section will summarize and analyze background data relating to:

- a. Traffic circulation
- b. Scenic routes
- c. Public transit
- d. Other transportation facilities
- e. Traffic study areas
- f. Traffic mitigation project

1. The first part of the report deals with the general situation of the country and the position of the various groups of the population. It is a very interesting and informative study of the social and economic conditions of the country.

2. The second part of the report deals with the political situation of the country. It is a very interesting and informative study of the political conditions of the country.

3. The third part of the report deals with the cultural situation of the country. It is a very interesting and informative study of the cultural conditions of the country.

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2. Traffic Circulation

a. Area-wide Circulation

The City is served by two major freeways, Interstate Route 80 and State Highway 4. I-80 provides access to the San Francisco Bay Area, Sacramento and to the western states. Route 4 connects I-80 with the Sacramento delta and central Contra Costa County. See Figure III.1.

I-80 is presently six lanes and the Department of Transportation is considering an expansion to an eight-lane facility with possibly a future expansion of Bay Area Rapid Transit (BART) system paralleling I-80 in the Hercules area. Route 4 is partly a freeway and partly a two-lane highway between I-80 and Martinez, and is planned for expansion to a six-lane freeway. Several existing ramp connections to these two freeways serve the City via Willow Avenue, San Pablo Avenue, and Bayberry. San Pablo Avenue provides a connection to communities north and south of Hercules and serves as a by-pass for I-80 when freeway traffic is congested.

b. Local Circulation

In September, 1994, the General Plan Circulation Element - Transportation Technical Report was prepared by DKS Associates. This study measured the existing traffic conditions throughout the City and projected traffic conditions which can be expected by the year 2010.

Land Use Assumptions

The focus of the study is the peak hour condition at full "Build-out" (i.e. development) of land both within the City and its sphere of influence to the east along Route 4. Travel demand on the transportation network was estimated using the West County Travel Demand Model. For this study, the year 2010 land use database was refined to reflect changes in plans since 1990 (see Table III.1 and Figure III.2). Details of the revised household and employment projections used in the land use file are provided in Table A-2 of the separately bound Transportation Technical Report Appendices document.

Network changes anticipated to occur by buildout were also incorporated into the model (see Table III.2 and Figure III.3). Local connections to projects were also incorporated into the model, based on assumptions developed in conjunction with City staff and information contained in adopted planning documents.

The first part of the paper is devoted to a review of the literature on the topic. The second part is devoted to a description of the experimental design and the results of the experiment. The third part is devoted to a discussion of the results and the conclusions of the paper.

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3. Transportation Improvements

Identifying the transportation improvements which must be constructed in order to achieve the City's General Plan Policy of maintaining a Level of Service D or better for peak hour traffic operating conditions is a three-step process.

First, the quantified land uses are combined with the appropriate trip generation rates in the traffic model to determine the number of peak hour trips which would be generated on roadways and at specific intersections. Secondly, the traffic model is then used to determine the Level of Service of traffic operation at intersections in the City were developed to full "Build-out" without any improvements to the circulation/transportation system. Third, the model is used to identify which specific transportation improvements need to be constructed in order to achieve a Level of Service D or better in the City.

There are several transportation improvements included in the City's Capital Improvement Program (CIP) and the Highway 4 West and San Pablo Avenue Circulation Improvement Plan. Table III.3 lists each project that has committed funding or is reasonably assured of being completed. The location of these projects is shown on Figure III.4.

Projected levels of service for major intersections in 2010 are shown in Table III.4. Two intersections would operate below an acceptable level during both the weekday A.M. and P.M. peak hours: San Pablo Avenue/Sycamore Avenue and San Pablo Avenue/John Muir Parkway. Both of these intersections are projected to operate at LOS F in the future. Because these two intersections are adjacent to each other, they share a common congested segment of San Pablo Avenue. This segment of San Pablo Avenue, between SR 4 and Sycamore Avenue and further south to the city limit is the only deficiency identified for Year 2010 conditions.

The recommended circulation plan should include all of the committed improvements discussed in Section 3, plus measures to alleviate remaining deficient conditions anticipated at buildout of the City of Hercules. As noted in Section 3, the main deficiency identified in Hercules is the section of San Pablo Avenue between Sycamore Avenue and the south City limit.

San Pablo Avenue is designated as a regional route in the West Contra County Action Plan for Routes Of Regional Significance. As such, it is not subject to the same level of service standards as other "basic routes." Rather, it is subject to a traffic service objective, which is level of service E. The congestion on this section of San Pablo Avenue is due, in large measure, to diversion of traffic from I-80. Analysis of the travel demand modeling indicates that about one-third of the morning peak hour traffic on this section of San Pablo Avenue would use I-80 instead if there was adequate capacity.

The first part of the paper discusses the importance of the research and the objectives of the study. It also provides a brief overview of the methodology used in the study.

The second part of the paper presents the results of the study. It discusses the findings of the research and compares them with the existing literature. The results show that there is a significant difference between the two groups of participants.

The third part of the paper discusses the implications of the findings. It suggests that the results of the study have important implications for the field of research. The authors also provide some recommendations for future research.

The fourth part of the paper concludes the study. It summarizes the main findings and reiterates the importance of the research. The authors also provide a final statement on the significance of the study.

The fifth part of the paper is a reference list. It contains a list of all the sources cited in the paper. The references are arranged in alphabetical order.

The sixth part of the paper is an appendix. It contains additional information that is not included in the main text of the paper. The appendix is organized into sections and subsections.

The West County Action Plan cites several potential measures for improving congestion on San Pablo Avenue. The City of Hercules has already programmed a signal coordination project for the four traffic signals between Willow Avenue/Parker Avenue and Hercules Avenue. While these projects are important with respect to improving traffic flow in Hercules, they would not have a large impact on San Pablo Avenue traffic operations between Sycamore Avenue and SR 4/John Muir Parkway. The Action Plan cites the following additional measures:

III.1 Responsibility Of WCCTAC Jurisdictions

With an objective to maintain LOS E or better, these measures should be implemented:

- monitor level of service on San Pablo Avenue
- encourage completion of Richmond Parkway
- discourage through traffic on I-80 from diverting onto to local streets (through improvements to I-80 such as the HOV lane construction by Caltrans scheduled to begin in 1995, and by requesting CCTA to develop, in conjunction with Caltrans and Solano County, a Traffic Operation System Management plan For I-80 that will regulate the flow of traffic on I-80 to respect the freeway's system's constraints and bottlenecks.)
- encourage I-80 traffic to stay on freeway and minimize early exits
- adopt design standards for new development to minimize turning movements on and off of San Pablo Avenue (try to minimize the number of access points on and off of San Pablo Avenue)
- synchronize signal timing throughout the San Pablo Avenue corridor
- emphasize HOV use of I-80 and encourage transit use in the corridor
- encourage diverted traffic to return to I-80 on the next downstream feeder road through improved signage
- clearly identify feeder roads for diverted motorists to return to I-80
- support WestCAT's efforts to assess need for improved transit service along San Pablo
- support extension of bicycle lanes to encourage more usage

III.2 Responsibility Of City Of Hercules

With an objective to maintain LOS E or better, these measure should be implemented:

- explore feasibility of construction of a second northbound right turn lane between Sycamore Avenue and SR 4 to allow right turns from westbound Sycamore Avenue while preserving the public investment in the City of Hercules transit transfer station (the new park and ride lot at parcel 10)

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The second part of the paper presents the results of the study and discusses the implications of the findings.

The third part of the paper discusses the limitations of the study and suggests areas for future research.

The fourth part of the paper concludes the study and provides a summary of the main findings.

The fifth part of the paper discusses the implications of the study for practice and policy.

The sixth part of the paper discusses the implications of the study for future research.

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- promoting commuter rail and a train station in the city to intercept through travelers on I-80.

Of the measures listed above, only the first measure cited particularly for the City of Hercules would cause measurable changes in service levels at the San Pablo Avenue/Sycamore Avenue and San Pablo Avenue/John Muir Parkway intersections. The additional northbound right turn lane would not improve the service levels at these intersections to LOS E, however. Even with major geometric changes at these two intersections, the service levels would still be projected to operate at LOS F, with a volume-to-capacity (V/C) ratio of just over 1.00. The geometric improvements would involve making San Pablo Avenue a six lane arterial between Sycamore Avenue and SR 4/John Muir Parkway and adding several turn lanes to accommodate major turn movements. The turn lane additions that would have to be considered, in addition to widening San Pablo Avenue, would create three westbound to southbound left turn lanes and a second southbound to eastbound left turn lane at John Muir Parkway. At Sycamore Avenue, a third southbound to eastbound left turn lane and a third westbound to northbound right turn lane would be needed to get the service level close to LOS E.

The City would need to consider not only the construction cost of these improvement but also the right-of-way costs and visual impacts. There is currently a median of varying width in the middle of San Pablo Avenue between Sycamore Avenue and John Muir Parkway. The median width varies due to the left turn pockets at the intersections. A striped bike lane and landscaping about San Pablo Avenue along its western frontage (adjacent to the southbound lanes). Along the eastern side of San Pablo Avenue between Sycamore Avenue and John Muir Parkway, there is a striped bike lane and a sidewalk adjacent to the future park and ride lot.

Intersections with triple left turn lanes are very unusual and generally indicate the need for an alternative approach to improvements. Approaches to significant over-capacity conditions that are typically used include construction of new parallel facilities or the use of grade separations to eliminate conflicting turning movements. It is also common to look for alternative transportation modes to take up the excess demand.

III.3 Potential Circulation Improvements

Hercules has several options relating to how to address the future deficiency on San Pablo Avenue: The first would be to accommodate the heavy travel "desire line" in the I-80 corridor through additional access and capacity enhancements on San Pablo Avenue. Some or all of the following circulation improvements could help alleviate some of the future congestion identified for San Pablo Avenue:

- a. **I-80/SR 4 Interchange Improvements.** Due to the existing ramp configurations, San Pablo Avenue between John Muir Parkway and Sycamore Avenue acts as part of the I-80/SR 4 interchange. Providing direct connections from the freeways to San Pablo Avenue with potential flyovers of the critical intersections would take some of these movements out of critical intersections.
- b. **Increase Capacity on San Pablo Avenue.** Widen San Pablo Avenue from four lanes to six lanes between John Muir Parkway and the southern Hercules City limit.
- c. **Grade Separations.** Grade separate the intersections of San Pablo Avenue and John Muir Parkway and San Pablo Avenue and Sycamore Avenue. The grade separations would allow through traffic on San Pablo Avenue to not interfere with turning movements at these intersections. Much of the through traffic on San Pablo Avenue is traveling through the City to and from points outside of Hercules. The turning movements at these intersections involves motorists traveling to and from points within Hercules.

These actions would provide additional capacity, and would encourage use of San Pablo Avenue as a bypass route to the freeway. Although widening of San Pablo Avenue may be possible in Hercules, it would be more troublesome in Pinole. The regional consensus on I-80 corridor capacity issues that developed from the *West County Action Plan* is that diversion of traffic away from I-80 onto San Pablo Avenue should be discouraged, rather than encouraged. The capacity enhancements discussed above would be counterproductive to this regional consensus.

The second option is to continue to work with other West County jurisdictions and regional transit agencies to develop alternatives to single-occupant automobile use in the I-80 corridor. This would include pursuing BART extensions in West County, commuter rail service to Solano County, and improved bus connections. The blueprint for this approach is provided in the *West County Action Plan*. It should be recognized that this approach is not likely to result in meeting the traffic service objective on San Pablo Avenue (level-of-service E) if the land development in western Contra Costa County, Solano County and the remainder of the Bay Area occurs generally as anticipated in the *West County Travel Demand Model*.

Considering the options, we suggest the "transportation alternatives" approach as most appropriate for Hercules.

4. Scenic Routes

The two scenic routes within the City of Hercules are:

<u>Road Name and Category</u>	<u>Termini</u>	<u>Length</u>
State Route 4 Scenic Freeway	Interstate 80 to State Route 84	33.4 miles
San Pablo Avenue Scenic Thoroughfare	Pinole Valley Road to Interstate 80 at Crockett	6.6 miles

Both of these segments have been designated as City Scenic Routes (see Figure III.1).

San Pablo Avenue through the City of Hercules is presently a scenic corridor of relatively high environmental value and should be preserved and enhanced as the City grows and develops.

State Route 4 presents outstanding scenic qualities along its corridor, i.e. the Franklin Canyon Golf Course. Since Route 4 is an important window to the City, the general movement of the view from this facility is a desirable environmental goal. The City should be particularly interested in the design configuration and quality of landscaping in connection with future construction to freeway standards by the State.

5. Transit

a. Existing Service

The BART system connects the City of Richmond with Fremont to the south, Concord to the east and San Francisco and Daly City across the Bay and to the south. This system is primarily a fixed rail commuter service from outlying communities to major employment centers in the Bay Region. The most accessible BART station for Hercules is the El Cerrito Del Norte station, at Cutting Boulevard and I-80 in Richmond, nine miles south of Hercules.

Public Transportation within Hercules is provided by two agencies: Western Contra Costa County Transit Authority (WestCAT) provides the local service while the Bay Area Rapid Transit (BART) is the regional carrier. Their services are as follows:

Bus service in Hercules is currently served by AC Transit and WestCAT, as well as BART Express Bus (see Figure III.5). AC Transit Route 74 runs along San Pablo Avenue between Crockett and the Richmond BART station. It operates weekdays on one-hour headways, with a stop located at the WestCAT Transit

Transfer Station on John Muir Parkway just west of San Pablo Avenue. AC Transit Line 30Z travels along SR 4 from Martinez to Hercules, stopping at the WestCAT Transfer Terminal, and continuing on to the Richmond BART station. Line 30Z operates weekdays on one-hour headways.

WestCAT bus service is available throughout Hercules. Four lines operate on weekdays, and each line travels between the WestCAT Transfer Terminal and Sycamore Avenue. Line 10 runs along Turquoise Avenue, Pheasant and Sparrow. Line 12 travels along Sycamore Avenue, Redwood, Violet and Lupine. Line 13 covers Refugio Valley Road as well as Carson, Grissom and Coronado. Line 14 runs along Pheasant, Sparrow, Falcon and Refugio Valley Road west of Redwood. Each line operates on half-hour headways between 6:00 A.M. and 8:00 P.M.

WestCAT also provides door to door Dial-A-Ride service for senior and disabled passengers in portions Hercules and Rodeo not otherwise served by WestCAT. In Hercules, the Dial-A-Ride service area extends east of San Pablo Avenue and north of SR 4.

BART Express Bus Line J connects several points in northern and western Hercules with the El Cerrito Del Norte BART station. In Hercules, passengers can access the express bus at the North Shore Business Park and the Willow Avenue/I-80 Park & Ride lots. BART Express Line J operates on 30-minute headways during the week, and 40 minute headways on Saturdays and Sundays.

Park & Ride lots currently exist at the I-80/Willow Ave ramps intersections. Approximately 99 spaces are available for commuters in these lots. Connecting service to BART Express Bus Line J is available at these lots. Another Park & Ride lot, scheduled to open in the latter part of 1994, will be located on the east side of San Pablo Avenue between Sycamore Avenue and SR 4. The San Pablo Avenue Park & Ride lot will contain about 200 spaces and will also provide parking for commuters using AC Transit Line 74 and BART Express Bus Line J.

6. Other Transportation Facilities

The City is traversed by two railroad lines; the Southern Pacific and the Atcheson-Topeka and Santa Fe, which is a main line. At present there is no direct water or air service to the City. The deep water channel is several miles from the shoreline at Hercules. The City is conveniently located to two international airports - Oakland and San Francisco.

C. POLICIES AND PROPOSALS

1. Objectives

The basic objectives of the Circulation and Scenic Highway Element are to:

- 1) Provide for the movement of people and commodities in the City, and
- 2) Plan for the preservation and enhancement of visual qualities as viewed from designated scenic routes. Subgoals of these basic objectives are to:
 - a. Established a long-term program for the construction of streets and preservation of future rights-of-way based on traffic projections.
 - b. Coordinate the street system with land use and other elements of the General Plan.
 - c. Unify the City with a functional internal street system of arterials, collectors, and local streets.
 - d. Provide adequate access from the freeways to the surface street system.
 - e. Coordinate the City's street system with adjoining city, county and state facilities.
 - f. Maintain acceptable local circulation operating conditions on arterial streets/intersections and on local collector streets.
 - g. Minimize through traffic in residential neighborhoods.
 - h. Promote public transit service within the City and area.
 - i. Provide a comprehensive system of riding and hiking trails.
 - j. Provide for needed transmission facilities in a manner compatible with other elements of the General Plan.

2. Policies

- a. The policy on traffic level of service reflects the "traffic service objectives" set out in the West County Action Plan. The City has adopted a Growth Management Element to comply with Contra Costa County Measure C (1988). This included adoption of level of service standards on "basic

routes" depending on the location of the route: CBD (central business district), urban, suburban, semi-rural and rural.

As also noted in the Growth Management Element of the General Plan, the following are the traffic service standards for Basic Routes (Local Streets) in Hercules:

LOS "High" D to "Low" E (maximum v/c ratio is 0.94)

- Sycamore Avenue (from Bayberry to San Pablo Avenue)
- Bayberry (from I-80 ramps to Sycamore)

LOS "High" D - (maximum v/c ratio is 0.89)

- Sycamore Avenue (SR-4 - Bayberry)
- Refugio Valley Road (Sycamore - Redwood/Falcon)
- Alfred Nobel Drive
- Linus Pauling Drive
- James Watson Drive
- John Muir Parkway

LOS "Low" D - (maximum v/c ratio is 0.84)

- All other Basic Routes (that is, except Routes of Regional Significance).

Measure C calls for "routes of regional significance" to have a separate "traffic service objective" set cooperatively by all the jurisdictions of western Contra Costa County. Routes of regional significance in Hercules are: I-80, SR 4 and San Pablo Avenue. The Circulation Draft of the West County was published on July 29, 1994, and recommends a traffic service objective of LOS E at signalized intersections on San Pablo Avenue.

For health, safety and general welfare, it is the City's policy to provide adequate levels of traffic service throughout the City. Level of Service D or better is the city wide standard for traffic operating conditions during peak hours on residential streets and intersections. Level of Service D for the commercial/industrial development is acceptable under the following conditions:

- 1) striving for off-peak uses
- 2) producing Living Wage jobs
- 3) generating City Revenue and/or

- 4) proposing development that is otherwise highly desirable community-wide.
- b. Neighborhood design should discourage through traffic on local streets.
- c. Residential streets will be designed in relation to the needed capacity and the adjoining housing patterns.
- d. Proposed elements within view of designated scenic routes in the City should be reviewed in terms of their visual impact.
- e. The City should actively participate in cooperative efforts to provide effective public transit to the City and adjacent communities, including promoting commuter rail and a train station in the City to intercept through travelers on I-80.
- f. The City should promote the establishment of riding and hiking trails throughout the community and coordinate with other agencies planning trail systems in the area and region.
- g. Major transmission and fuel lines should be reviewed to ensure compatibility with affected General Plan elements.

3. Proposals and Standards

a. Traffic Circulation

The Circulation Plan (Figure III.6) shows three classifications of traffic facilities:

Freeways, arterials and local collector streets as well as freeway interchanges, railroads, scenic routes, and future highways.

1) Freeways

Freeways are routes designed to carry heavy traffic volumes over long distances. Access is controlled, crossings are grade separated and lanes in opposite directions are separated by medians.

Interstate 80 is a six-lane freeway proposed for widening to eight lanes and State Route 4 is partly a freeway and is planned for expansion to a six-lane freeway. Figure III.6 shows the proposed interchanges of these freeways with arterial city streets.

2) Arterial Streets

Arterial streets provide the principal traffic circulation system within the community. They also provide the transition between collector and local streets and the freeway system. Arterials are high volume streets having two or more moving lanes and a parking lane in each direction. They sometimes have median strips and turn lanes and usually have traffic signals at major intersections. The arterial streets in Hercules are San Pablo Avenue, Willow Avenue, Sycamore Avenue and Refugio Valley Road.

3) Local Collector Streets

Local collector streets provide the transition between arterial streets and land uses within the community. The configuration of these streets will depend on the amount of traffic they will carry and the manner in which access is provided to adjoining land uses.

b. Scenic Routes

San Pablo Avenue and State Route 4 are designated as scenic routes in the City (see Figure III.6).

c. Transit

Convenient and efficient public transit service in the City should be provided to offer an attractive alternative to the automobile.

D. IMPLEMENTATION

1. Establishment of planning liaison with the Federal, state and regional agencies concerned with transportation to ensure the coordination of their projects with the policies of the circulation element.
2. Designation of a local select system of arterial and collector streets to be eligible for State and Highway Trust Fund monies.
3. Investigation of the use of grant funds from regional, state and Federal agencies such as the Department of Transportation, and the Department of Housing and Urban Development for the provision of specialized circulation facilities such as mass transit, hiking, biking and riding trails, and scenic highways.

4. Designation of rights-of-way in advance of development and encouragement and requirement of dedication of streets, paths and trails as part of the land development process.
5. Establishment of special assessment districts for street improvements, construction of bridges, provision of public transit or parking, etc.
6. Participation in local and regional Transportation System Management (TSM) programs, such as the City's adopted Transportation Demand Management (TDM) Program, which was developed by the West Contra Costa County Transportation Advisory Committee (WCCTAC) and includes guidelines for trip reduction measures.
7. Establish a traffic mitigation fee to be paid by all remaining development projects to offset the needed improvements outlined in the General Plan Circulation Element Transportation Technical Report.

Create a Transportation Management System (TSM) program.

8. Establish a traffic mitigation fee to be paid by all remaining development projects to offset the needed improvements outlined in the City-Wide Traffic Study.
9. Acquisition of rights-of-way and easements and directly construct improvements using local sources of funds.
10. Review of development proposals in terms of circulation and scenic route policies and proposals.
11. Support area-wide cooperative efforts to expand public transit service to the City and surrounding areas.
12. Encourage pedestrian and bicycle travel for home-to-work and home-to-local-shopping trips through the provision of pathways and bicycle storage.
13. As part of road construction projects, enforce dust control measures (such as watering graded areas daily) and require that contractors be responsible for the immediate clean-up of any materials spilled on city streets as a result of grading, construction or hauling operations.
14. Plan for construction of the road improvement projects identified in this Element through the City's Capital Improvement Program, and schedule each project according to current/projected congestion at the site of the improvement and the financial condition of the Traffic Mitigation Fund.

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6. The sixth part of the paper discusses the contributions of the study to the field.

7. The seventh part of the paper discusses the practical applications of the findings.

8. The eighth part of the paper discusses the ethical considerations of the study.

9. The ninth part of the paper discusses the funding of the study.

10. The tenth part of the paper discusses the acknowledgments of the study.

11. The eleventh part of the paper discusses the references of the study.

12. The twelfth part of the paper discusses the appendices of the study.

15. Continue programs that include:

- Trip reduction goals for private and public development;
- Actions to reduce peak hour private vehicle trips (e.g. flex-time, car pools, support of transit);
- Traffic routing controls;
- Further review of alternative funding sources; and,
- An implementing and enforcement ordinance.
- Alternative financing methods for fee payment which do not put the City at risk but ease the developer impact/burden.

16. There will be a roadway linkage between Refugio Valley west of San Pablo and the residential neighborhoods in the Chelsea by the Bay area. However, this linkage will be constructed using "traffic calming" measures as suggested in the response to comment I-3 on pages VIII.A-78 and VIII.A-79 of the FEIR. This approach would attempt to discourage through traffic by making travel on the Railroad Avenue connection less convenient and more time consuming than would be the case if an arterial linkage were to be constructed.



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